

REMARKS

Reconsideration of the present application is requested in light of the above-amendments and following remarks.

I. Status of the Claims

Claims 1-12 and 14-19 are pending. For the purposes of clarity only, Claim 2 has been amended to recite "said interaction between said probe and said portion of said acid feed stream" in place of "said interaction." Claim 11 has been amended to require a computer and an infrared analyzer equipped with a diamond-tipped ATR probe. Claim 18 has been amended to correct an informality therein. Support for the amendments can be found, for example, in original claims 2, 13 and 18. Claim 13 has been cancelled, without prejudice. No new matter has been added.

II. Summary of the Invention

Claims 1-10 are directed to methods of regulating the concentration of water in the acid feed stream in a process for the production of HF by providing an acid feed stream comprising acid, bound water, and free water, estimating the concentration of bound and free water by providing a probe in at least a portion of the feed stream, and adjusting the concentration of free water in the acid feed stream based on the estimating step. Claims 11, 12, and 14 are directed to methods of controlling water content of an acid by determining the concentration of water in the acid using an in-line measurement system comprising an ATR probe and adjusting the concentration of water in the acid based on the concentration measured using the in-line system. Claims 15-19 are directed to methods of manufacturing hydrofluoric acid using an in-line system according to the claimed invention.

Important to the claimed invention is the discovery that the concentrations of both bound and free water, and other components, in an acid feed stream can be measured directly via a probe in the stream (see claims 1-10) or via an in-line system as specifically required by claims 11, 12, and 14-19. Such a discovery is highly advantageous in that the concentrations of bound water, free water and other components in an acid feed stream, for example, as produced in the production of hydrogen fluoride, can be measured more readily as compared to conventional, and adjustments to the amount of water in the stream, if necessary, can be made without substantial delay inherent in isolating and testing a sample as required in conventional methods. In addition, by measuring both

bound water and free water, the adjustments to the amount of water necessary in an acid feed stream can be more accurately and efficiently made. Accordingly, HF product streams in accordance with the present invention can be controlled to get better product in higher yield.

II. The Claims Meet All The Requirements of 35 U.S.C. §112

The Examiner rejected claims 1-19 under 35 U.S.C. §112, second paragraph as being indefinite. More specifically, the Examiner stated “[i]n claims 1, 11, and 18, it is unclear what is required by ‘regulating’ or ‘adjusting’, is the concentration of water is [sic] regulated or adjusted to achieve a certain result or a certain effect?”

In reply, applicants respectfully submit that one of skill in the art would clearly comprehend the scope of the terms “regulating” and “adjusting” as recited in the claims in light of the teachings in the present application and in the art. Accordingly, such claims are not indefinite and the Examiner’s rejections should be withdrawn. “Definiteness of claim language must be analyzed, not in a vacuum, but in light of: (A) The content of the particular application disclosure; (B) The teachings of the prior art; and (C) The claim interpretation that would be given [by one of ordinary skill in the art].” MPEP 2173.02.

In the instant case, on page 10, lines 21-22, page 11, and page 12, lines 1-17 of the application, the terms “regulating” and “adjusting” are clearly defined to require either reducing or increasing the concentration of water in an acid feed stream based on the amount of free water measured in the feed stream via a probe of the claimed invention. In light of such description, one of skill in the art would clearly comprehend whether a potentially infringing process involved the step of increasing or reducing (“adjusting”) the concentration of water in an acid stream based on an estimated amount of bound and free water as presently claimed. Applicants are unaware of any requirement under 35 U.S.C. § 112, second paragraph that would compel the inclusion of further limitations as suggested by the Examiner when the scope of the terms “regulating” and “adjusting” are readily apparent to those of skill in the art. Accordingly, applicants submit that the terms “regulating” and “adjusting” as claimed are definite, and the Examiner’s rejection should be withdrawn.

The Examiner further asserted that “[i]n claim 2, there is no clear antecedent basis for ‘said interaction.’” Claim 2 recites the limitation of “wherein said probe *interacts* with said portion of said acid feed stream and generates an information signal based on *said interaction*.” In reply,

therefore, applicants respectfully submit that the antecedent basis for “said interaction” is inherent in claim 2. “Inherent components of elements recited have antecedent basis in the recitation of the components themselves.” MPEP 2173.05(e).

In the present claim, the antecedent basis for “said interaction” clearly comes from the recitation of the probe interacting with a portion of the acid stream. When the probe interacts with a portion of the acid stream, there must inherently be an interaction therebetween. Accordingly, original claim 2 contained antecedent basis for the recital of “said interaction” in line 2 of the claim. Nevertheless, for the purposes of further clarity, applicants have amended claim 2 to recite “said interaction between said probe and said portion of said acid feed stream.” In light of the above, the Examiner’s rejection is improper and should be withdrawn.

III. The Claimed Invention is Patentable Over WO 97/35187

The Examiner rejected claims 1-19 under 35 U.S.C. 103(a) as being unpatentable over WO 97/35187 (“WO ‘187”). More specifically, the Examiner asserted that WO ‘187 discloses a process for continuous production of hydrogen fluoride and a process for determining the concentration of water in a mixture containing sulfuric acid, water, and hydrogen fluoride wherein:

[t]he process for determining the concentration of water is described in WO ‘187 as a method of determining the concentration of each component of a ternary mixture essentially consisting of sulfuric acid, hydrogen fluoride, and water, which comprises measuring at least one set of three physical quantities, namely (1) temperature, (2) ultrasound propagation velocity, and (3) electrical conductivity or viscosity, of the ternary mixture and converting measured values to the concentrations of the respective components according to calibration curves representing the relationships of the concentrations of respective components of a ternary mixture composed of sulfuric acid, hydrogen fluoride, and water with the above-mentioned three physical quantities as separately constructed beforehand (note paragraph bridging pages 6-7). WO ‘187 further discloses that the use of a computer is desired in order to conduct the treatment accurately and fast (note first paragraph on page 14).

The Examiner acknowledged that “WO ‘187 does not specifically disclose [sic] the use of a probe comprising a diamond tipped ATR probe.” However, the Examiner concluded:

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to use any known means in the art to perform the functions required in WO ‘187 in order to accurately estimate the amount of water, without a showing of criticality or unexpected results, the use of such probe is not seen as a patentable difference since the probe is a known and commercially available means in the art.

In reply, applicants respectfully submit that WO ‘187 cannot be properly modified to

achieve the claimed invention and therefore does not establish a *prima facie* case of obviousness. In particular, applicants submit that WO '187, even in light of the Examiner's assertion (with which the applicants do not agree), fail to teach or suggest each and every limitation of the present invention. In addition, applicants note that the Examiner's suggested modification of WO '187 would impermissibly render it unsuitable for its intended purpose. Accordingly, the assertions by the Examiner fail to establish a *prima facie* case of obviousness, and the rejections under 35 U.S.C. §103 should be withdrawn.

WO '187 is directed to methods for indirectly measuring the concentration of the three components in a ternary acid mixture comprising sulfuric acid, hydrofluoric acid, and water. In particular, the WO '187 methods involve measuring the (1) temperature, (2) ultrasonic wave propagation velocity, and (3) electric conductivity or viscosity of a given acid component mixture, and plotting such data onto one or more calibration curves to indirectly estimate the total concentration of each component based on the non-concentration measurements (1), (2), and (3).

However, WO '187 fails to teach or suggest a method of regulating water content including the step of estimating the amount of **bound and free** water in a stream as specifically required by claims 1-10 and 18-19, or even the amount of just the free water, required by claims 15-17. This is fundamentally different than a method which measures just the total concentration of water in the stream. The Examiner has not provided any teaching or suggestion of measuring bound and free water, and applicants are unaware of any of such teaching in the cited art. Accordingly, the Examiner's asserted rejection of claims 1-10 and 15-19 is based on a document which fails to teach or suggest each and every limitation of the claims and therefore the rejection should be withdrawn with regard to these claims.

In addition, applicants respectfully submit that WO'187 fails to teach or suggest any method for regulating and measuring water in a stream comprising sulfuric acid, hydrofluoric acid, fluorosulfonic acid, and water, as required by claims 5, 12, and 16 of the claimed invention. Rather, WO'187 discloses a method suited only to measuring water in a **three-component stream** comprising sulfuric acid, HF, and water (see, for example, WO'187 abstract). One key to the WO'187 method is the use of calibration curves specifically designed for calculating component concentrations in such three-component mixtures. The curves taught in WO'187 are not designed to, and cannot, be used to calculate concentrations in a four component mixture such as is claimed instantly. The WO'187 disclosure provides no guidance or teaching suitable for use in measuring

water in any four-component mixture, or even in any mixture comprising anything other than just sulfuric acid, HF, and water. Accordingly, WO'187 fails to provide any motivation or likelihood of success for measuring four-component mixtures. Thus, WO'187 cannot be modified as suggested by the Examiner to achieve the invention embodiments of claim 5, 12, and 16, and the Examiner's rejection should be withdrawn.

Moreover, applicants respectfully submit that the Examiner's suggestion to modify the method of WO '187 to include the use of an in-line ATR probe, as required by claims 4, 11, 12, 14, and 18-19, would render the WO '187 method inoperable and unsuitable for its stated purpose. As noted above, the WO'187 process requires the measurement of three variables: temperature, ultrasonic wave propagation velocity, and electric conductivity or viscosity. While the Examiner acknowledged that WO'187 does not teach or suggest the use of an ATR probe, the Examiner nevertheless suggested it would be obvious to use such a probe in WO'187 to measure at least one of the required variables therein. However, applicants submit that **none** of the "required variables" to be measured in WO'187 can be measured using an in-line ATR probe. Rather, an ATR ("attenuated total reflection") probe is designed to measure IR, visible or UV absorbance data associated with a stream – not temperature, ultrasonic wave propagation velocity, electric conductivity or viscosity. (See, for example, attached ATR product description from Custom Sensors and Technology). Accordingly, the Examiner's suggestion to use an ATR probe in WO'187 would not allow one to take any of the measurements required by WO'187 and would render such method inoperable. Such suggested modification is therefore impermissible and cannot support a *prima facie* case of obviousness. Thus, claims 4, 11, 12, 14, and 18-19, all of which require the use of an ATR probe, are clearly patentable over the Examiner's cited art.


In light of the above, it is clear that the Examiner's suggested modification of WO'187 to achieve the claimed invention is improper and fails to establish a *prima faice* case of obviousness. Accordingly, the Examiner rejections should be withdrawn, and the claims allowed.

IV. CONCLUSION

Reconsideration is respectfully requested. In view of the above remarks, it is urged that the present application be allowed. An early and favorable response is earnestly solicited.

Respectfully submitted,

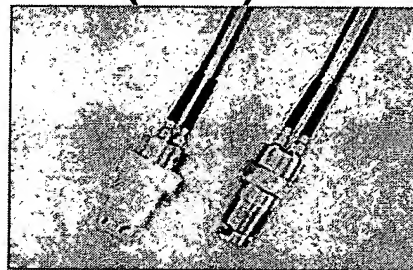
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Brett T. Freeman
Reg. No. 46,709
Synnestvedt & Lechner LLP
2600 Aramark Tower
1101 Market Street
Philadelphia, PA 19107-2950
Telephone: (215) 923-4466
Facsimile: (215) 923-2189

Fiber Optic Attenuated Total Reflection (ATR) Probe

The patented CS&T Fiber ATR Probe is a tip-submersible, in-situ probe that permits measurement of the UV, Vis or NIR absorbance of extremely opaque liquid samples in a process environment and can be used also in a laboratory environment with compatible spectrophotometers. The effective path length of an ATR probe is on the order of two micrometers and is wavelength dependent.

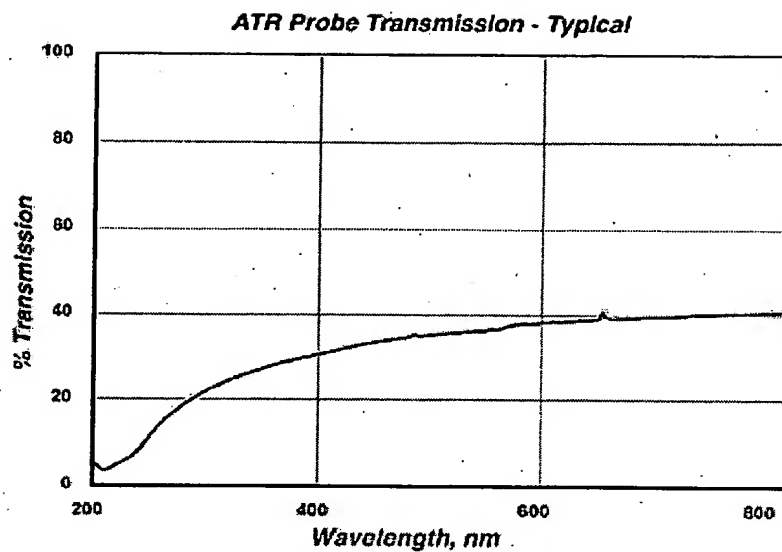


The Fiber Optic ATR Probe is available in two configurations: threaded to fit into a 3/4-inch NPT coupling or a 25 mm sanitary fitting. The ATR Probe is offered in materials such as 316SS (standard), titanium, Hastelloy® or Techtron™ PPS. The probe window has epoxy (standard) or mechanical seals. The wetted ATR crystal is sapphire.

ATR Probe Specifications - Typical

Part number	5025/5026 threaded/sanitary
Temperature w/ mechanical window	<130°C
Pressure	<250 psig
Path length	~2 micron
Probe body material	316 SS (std.)
Optics material	Sapphire (std.)
Probe dimensions	3/4-inch diameter; 4-1/2 inches long
Fiber optic connections	SMA905
Optical fiber designation	600μ core, silica/silica, N.A. = 0.22
Transmission*	10-20%
*@ 340 nm & air in sample volume	

The graph below shows a typical throughput for an ATR Probe with air in the sample volume:



Custom Sensors & Technology

A division of Custom Sample Systems, Inc

531 Axminster Drive

Fenton, MO 63026-2903

Tel: (636) 305-0666

Fax: (636) 305-1096

email: cstinfo@customsensors.com